STATE OF MINNESOTA DISTRICT COURT

COUNTY OF RAMSEY SECOND JUDICIAL DISTRICT

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The State of Minnesota,
by Hubert H. Humphrey, III,
its attorney general,
and
Blue Cross and Blue Shield
of Minnesota,

Plaintiffs,

vs. File No. C1-94-8565

Philip Morris Incorporated, R.J.
Reynolds Tobacco Company, Brown &
Williamson Tobacco Corporation,
B.A.T. Industries P.L.C., Lorillard
Tobacco Company, The American
Tobacco Company, Liggett Group, Inc.,
The Council for Tobacco Research-U.S.A.,
Inc., and The Tobacco Institute, Inc.,

Defendants.

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DEPOSITION OF ALEXANDER W. SPEARS III

Volume I, Pages 1 - 94

(The following is the deposition of ALEXANDER W. SPEARS III, taken pursuant to Notice of Taking Deposition, at the offices of Womble, Carlyle, Sandridge & Rice, Attorneys at Law, 3300 One First Union Center, 301 South College Street, Charlotte, North Carolina, on September 25, 1997, commencing at approximately 2:00 o'clock p.m.)

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Judge Fitzpatrick, via teleconferencing

I N D E X

EXHIBITS		DESCRIPTION	PAGE MARKED
Plf Ex	1255	Memo dated July 24, 1996, Johnson to Sudholt, Bates 88029439-60	60
	1256	Memo dated September 18, 1996, Johnson to Sudholt, Bates 89291533-45	60
	1257	Memo dated March 1, 1996, Walker to Sudholt, Bates 89802438-51	60

P R O C E E D I N G S

(Witness previously sworn.)

MR. MONICA: After a discussion off the record, we are going to move to a portion of Mr. -- Dr. Spears', rather, testimony dealing with his expert opinion. Because of technical problems we were not able to continue with the Category II testimony because we cannot encrypt either the television signal nor the CaseView signal, but we're still working on that, so Bruce has agreed to go ahead and start with the expert -- expert witness portion. So therefore we're going out of Category II mode, and the record can now be the normal record. But everything from the identification of the first Category II document thus far, which is Plaintiffs' Exhibit 1251, and forward to this point, should be under seal in -- in accordance with the Category II procedures.

Counsel for Philip Morris is now back in the room, but when we again go back to Category II, we're going to have to, of course, go back to the normal Category II procedures.

Thank you.

MR. FINZEN: Before we begin the questioning, Mr. Monica, I've had an opportunity

briefly, through the chaos in the room, to look at the three documents that were produced this morning on the record of the CEO and 30.02 deposition of Alexander Spears, and I would ask before we proceed to take this deposition to have you verify for me, if you would, on the record, that this is all of the testing that exists at Lorillard on the issues that are covered by these three documents not previously produced in the Minnesota litigation.

MR. MONICA: Mr. Finzen, I'm not in a position to guarantee that that's every document. We have produced all documents falling within the scope of your document requests that are within the time period, which is August of 1994. These documents are beyond that period, but because they were referenced by Dr. Spears, we're producing them now.

I don't know the answer to your question, but any document on these subjects that -- within the date range and within the scope of your prior request would have been produced, to the best of my knowledge.

MR. FINZEN: Well I ask because, obviously, if there are other documents that are past what you consider to be the applicable document cutoff date that deal with these issues but have not been

produced, then obviously we're dealing with selected documents from a category, and it makes it impossible for me to be able to cross-examine the witness with regard to all of the documents that may relate to the subject rather than just some that were selected individually. That -- that's why I asked.

MR. MONICA: We have produced what I understand to be the documents pertaining to the subject, but you, of course, are free to ask Dr. Spears if there are any others between the cutoff date and this period that exists on this subject. I am -- I am not in a position to answer your question; I don't have the knowledge to do so.

MR. FINZEN: And you have made no inquiry?

MR. MONICA: We've asked for the documents on these subjects, and I believe we have them, but I cannot tell you that every conceivable document that might apply to these subjects are -- that these -- these consist of every conceivable document. I do not know the answer to that.

MR. FINZEN: All right.

ALEXANDER W. SPEARS III

called as a witness, being previously sworn, was examined and testified as follows:

ADVERSE EXAMATION

BY MR. FINZEN:

Q. Sir, would you state your educational background, please.

A. Yes. I have a Ph.D. in chemistry, physical organic chemistry from the University of New York at Buffalo, State University of New York at Buffalo.

Are you interested in earlier years?

Q. Yes.

A. I have a bachelor's degree in science from Allegheny College, again with a major in chemistry. Prior to that I attended Murphysburg Academy from which I graduated in the equivalent of the 12th grade.

Q. Have you done any post-doc work in any subject area?

A. No, I have not.

Q. Have you taken any course work in any area following your Ph.D. that did not result in some form of a degree being awarded?

A. I taught chemistry. I would think that would be relevant. I taught all -- all levels of through a chemistry major at a local college in Greensboro, North Carolina called Guilford College in the 1960s, also taught in the Millard Filmore Division of what

was then the University of Buffalo when I was there, again teaching in the chemistry field. Those are the things that I remember.

Q. Have you taken courses in any other scientific discipline in university since your Ph.D.?

A. Not at universities that I can recall.

Q. Have you taken --

A. I take that back. I have taken courses in mass spectroscopy at the Stevens Institute, and that's the only one that comes to mind.

Q. Do you have any degree in medicine?

A. No, I do not.

Q. Do you have any degree in physiology?

A. Physiology?

Q. Yes.

A. No. My degree is what I've indicated.

Q. Do you have any degree in pathology?

A. No.

Q. Do you have any degree in pharmacology?

A. No.

Q. Do you have any degree in veterinary medicine?

A. No.

Q. Do you have any degree in psychology?

A. No.

Q. Do you have any degree in neurology?

A. No. I told you the degree that I have. It would be simpler if you just list that.
Q. Do you have any degree in epidemiology?
A. No. I do have a minor in mathematics.
Q. Have you taken any course work at university in any medical courses?
A. No.
Q. In any courses in physiology?
A. No.
Q. Any course work in pathology?
A. No.
Q. Any course work in pharmacology?
A. No.
Q. Any course work in veterinary medicine?
A. No.
Q. Any course work in psychology?
A. No.
Q. Any course work in neurology?
A. No.
Q. Any course work in epidemiology?
A. No.
Q. You have been designated in this litigation by Lorillard as an expert to give expert testimony. Can you tell me the areas in which you intend to render opinions as an expert in this litigation?

A. I thought that had been supplied in the materials that were forwarded with respect to the areas in which I would testify as an expert.
Q. Right. I have your expert report, and now I am taking your deposition as an expert, and I'm asking you what are the areas in which you expect to testify at trial as an expert.
A. Well I'm not sure I can cover each -- each one from memory, but I can try, if that's the request.
Q. Well would it assist you to have your expert --
A. Yes, it would.
Q. -- report?
MR. FINZEN: Counsel, do you have a copy to make available to the witness?
MR. NORTHRIP: I do.
(Document handed to the witness.)
A. Okay. One of the areas will be with respect to cigarette design and effects upon tar and nicotine with respect -- that is, the effects that cigarette design have on tar and nicotine. I expect to testify on the historical research efforts of Lorillard as they relate to the chemical -- chemical work that Lorillard has done over the years with respect to identification of components with respect to following up on articles indicating that some

components of tobacco smoke have biological activity. I will talk about Lorillard's response to those over the -- over -- over history. I will talk about my view on causation and criteria for concluding causation in a scientific sense.

Q. Causation of what, sir?

A. Disease.

I'll talk about -- I can talk about my experience as a technical advisor to the National Cancer Institute Tobacco Working Group and the conclusions of that activity, and some of the -- the nature of the work that was done and the conclusions that were reached. Also speak regarding allegations pertaining to nicotine manipulation and spiking that have been made, particularly with respect to ammonia technology in the hands of Lorillard, and other additives, reconstituted sheet. And I will also provide information in terms of my knowledge of lawyer involvements or lack thereof in research, the company research upon the so-called safer cigarette. I may be also, I guess, called upon to comment on opinions that other witnesses may make in the case with respect to my expertise.

Those are the areas that I expect to and -- to be called upon to provide testimony.

Q. All right. With regard to the area concerning cigarette design and its effect upon tar and nicotine, what opinions do you intend to render on that subject matter?

A. I'm not sure I can give you all my opinions without any questions, but I would expect to discuss the reduction in tar and nicotine that has occurred from the 1950s to the present time. I would talk about the causes of those reductions or the technology that was developed to effect those reductions, and that would include such things as reconstituted sheet development, expanded tobacco development, improvement in control of porosity of cigarette papers, the advent and continuing evolution of the cigarette filter, including ventilation. I would talk about separately, I think, the evolution of the filter, first as a mechanical device for removal of particulate matter, and evolution of selective filters to remove materials other than just particulate matter in a selective fashion, up -- bring it up to current-day technology that now exists and is applied to cigarettes in the marketplace by Lorillard. Those are the principal elements that occur to me now that I would discuss with respect to the design of cigarettes over time.

Q. With regard to the reduction in tar and nicotine -- nicotine from 1950s to the present, what -- what are your opinions that you expect to render on that issue?

A. Well my opinion is that the sales weighted tar and nicotine of domestic cigarettes have been reduced from a level of about 35 milligrams of tar and about two and a half milligrams of nicotine down to a sales weighted average of about 11 or 12 milligrams today and a sales weighted nicotine average of about nine-tenths of a milligram, eight -- between eight and nine-tenths.

Q. And --

A. I can also comment on carbon monoxide, on other components reported routinely in tobacco smoke, and the impact that some of these design variables have had on carbon monoxide over time. I would -- I would also discuss the -- as I say, the technology -- technological changes that have caused these reductions or brought about these reductions, and that would include both changes in the tobacco that have occurred over time as it's grown by the -- by the farm -- farmers and available to the manufacturers, as well as the impact of the different elements of technology on tar and nicotine and carbon

monoxide.

Q. And in addition to testifying that over time the sales weighted tar and nicotine levels have been reduced, are you going to be rendering opinions with regard to that reduction as it relates to anything else?

A. Opinions as to -- well I was going --

What I'm saying is that I would discuss technology that has allowed that reduction to occur and the development of the technology over time in terms of the key -- what I would regard as key pieces which allow the -- or afforded this reduction over time. Of course the consumer response to these products has been an element, also, in reducing the sales weighted average.

Q. With regard to the effect of the reduced-over-time tar/nicotine levels, do you intend to render any opinions concerning that reduction and its effect on sales, on disease, on anything?

A. Well the sales weighted reduction is a combination of the yield of each cigarette type, brand, times the sales, so when I say "sales weighted," that is a -- it does involve the acceptance of the products in the marketplace. For example, it does know -- you --

If you can't sell a product, no matter what it is, it won't affect the sales weighted average. So these -- you have to consider design changes that are acceptable by the smokers, and that will be part of my discussion as to all the elements and progress that has been made in effecting that kind of reduction in the sales weighted tar/nicotine.

Q. Then that's from the standpoint of the cigarette design that has led to that; correct?

A. That's correct.

Q. My question is: Do you intend to render any opinions with regard to the fact of the reduction of the sales weighted tar and nicotine levels in relation to anything else?

A. Not at this time, no.

Q. What in your judgment are the cigarette design features that are most responsible for the reduction in the sales weighted tar and nicotine numbers?

A. I think the tobacco -- the --

The main elements are tobacco, reconstituted sheet, expanded tobacco, and filters, filter design.

Q. All right. Let's -- let's take each one of those starting with tobacco reconstituted sheet, or was that --

A. My first one was tobacco.

Q. Just tobacco alone.

A. Yes.

Q. All right. Let's start with that.

How does the tobacco itself play a role in the production of the sales weighted tar and nicotine average?

A. The tobacco that was grown in the 1950s in terms of --

The nature of the tobacco has changed. The tobacco grown at that -- back in that point of time -- in time was generally a -- what's referred to as a heavier-bodied tobacco that has a thicker kind of leaf which yielded higher levels of tar, everything else being equal, than the present-day types of tobaccos that are being grown. So the modifications in tobacco that's grown by the farmers, and this has occurred through looking for increased yields in the -- in the -- for the farmer, we've seen it -- an evolution of the type of tobacco and the properties of tobacco with respect to tar and nicotine yield in the cigarettes.

Density of the tobacco, for example, has been reduced over what it was at that point in time. Curing methods have also changed. And to some extent the cultural practices have been changed. The

culmination of all of these things I think has led to what I am regarding -- I'm -- I'm referring to as a change in the tobacco itself.

Q. What are the cultural practices that you're aware of that have changed?

A. Well by "cultural" I mean fertilization practices, the use of sucker control agents, the use of herbicides, pesticides. How they have changed over time, again, has led to changes in the properties of the tobacco.

Q. Okay. Anything else with regard to the tobacco aspect of the cigarette design that plays a role in the reduction of the sales weighted tar and nicotine?

A. No. I think that covers it.

Q. Okay. With regard, then, to the -- the RL sheet, --

A. Yes.

Q. -- what --

A. Well the RL sheet was developed, I guess, in the -- in the early 1960s, began to be used in that period of time, and the properties of the sheet, although there -- there was a number of different manufacturing processes developed and patented for the manufacture of the tobacco sheet, there were basically two -- two different methods, both of which

resulted in sheets, when smoked in a cigarette or as a hundred percent sheet, gave low yields of tar and nicotine. So the incorporation of this sheet in significant percentages in the blend allowed reduction in tar and nicotine yield in cigarettes.

Q. Okay. Anything else with regard to the RL sheet that contributes to the sales weighted tar/nicotine reduction?

A. No, that's -- that's it.

Q. And the third area was filters.

A. Third area is filters.

Q. Okay. What is the area of cigarette design --

A. Well the -- the earliest filters were inefficient; they were large fibers. I think the first filters were basically made of cotton or cellulose and removed very little of the aerosol particles, or tar as we refer to it. Filter design evolved, I guess, to more efficient filters. And one of the limiting factors on filters is the pressure drop that they create when they are packed tightly, and of course the more tightly you pack them, there is a relationship with removal efficiency for tar and nicotine, and over time there were limitations in -- in allowing -- or in -- in achieving high filtration because of the extreme pressure drops for the

materials that were available.

Over time the materials have changed. Particularly, the cellulose acetate has become the preferred material. Both the design of the fibers in terms of size, cross-sectional diameters, the shape of the fibers, crimp in the fibers, have all been technology evolving over time that allowed major improvements in efficiency of the filters without obtaining -- without creating pressure drops that place them out of the practical range.

Also talk about the selective filters, selective in the sense that -- oh, developments relating specifically to Lorillard were selective removal of phenol system, some of the volatile phenol system, and its application to our cigarettes. Talk about the charcoal filters that were developed back in the '60s or late '60s. Evaluation of this whole area of ciliastasis as it related to selective filtration and the ultimate conclusions. Again, this is not directly related to tar and nicotine, but many different components of tobacco smoke were looked at from a selective removal point of view and design of filters that might accomplish that. And then the -- I would say the evolution of the very low tar/nicotine cigarettes being brought about through

the advent of ventilation systems, air ventilation systems, in combination with the filters and their impact on tar/nicotine and some other components, particularly carbon monoxide.

Q. Any other aspect of the cigarette design that bears upon the reduction, sales weighted reduction in tar and nicotine over time?

A. The only other component of this is the cigarette paper itself. And I think I left out the expanded tobacco, which have I skipped inadvertently.

Q. Okay. And the role that the paper plays, what is your testimony with regard to that?

A. Well the paper is made with varying porosities, and over time the manufacturers have -- of paper have been able to produce papers with better and better control over the porosity and allows the -- I guess the use of more uniform papers and a more precise positioning of the dilution and properties of the paper with respect to burn rate, particularly, and its impact on the burn rate of the cigarette.

Q. And how does that affect the sales weighted tar and nicotine numbers?

A. Well if you have a highly porous paper, you will reduce tar and nicotine over a non-porous one. Those that were used in the 1950s were relatively

non-porous. They were also relatively slow-burning papers incorporating diammonium phosphate. Evolution -- the evolution has been to more-porous papers including sodium potassium citrate.

Q. And the effect on the tar and nicotine level from a more-porous paper is what?

A. A reduction, both with a more-porous paper and a faster-burning paper, result in a reduction of tar and nicotine, and these kind of papers tend to be employed more with the -- the lower tar/nicotine cigarettes.

Q. And what is it about the porous nature of the paper itself that reduces tar and nicotine?

A. Generally dilution; that is, air is coming in through the porous paper, and also some smoke components diffuse out of the porous paper. For example, carbon monoxide.

Q. And the burn rate simply means there are less --

A. There are fewer puffs if it's faster-burning, or more puffs if it's slower-burning.

Q. Okay. Anything else on the paper?

A. No. That would be --

Q. Then you mentioned last puffed tobacco.

A. Yes.

Q. What is the -- your testimony with regard to the

impact of puffed tobacco on the reduction of tar and nicotine?

A. The use of expanded tobacco results in the use of less tobacco in the cigarette; that is, it has a lower density, and there is a proportional decrease in tar and nicotine proportional to the reduction in tobacco that's in the cigarette. So that the use of the expanded tobacco impacts the tar and nicotine in that way to the degree it's being used to effect the reduction of tobacco weight in the cigarette.

Q. Any --

Anything else with regard to cigarette design that you expect to testify about?

A. Those are the elements that I -- I think I would testify about. None -- none others occur to me, at least at the moment.

Q. Then you mentioned testimony concerning historical research efforts as they relate to the work over the years to do chemical I.D. of components of smoke.

A. Yes. I will discuss the nature of the work and --

Q. What opinions do you expect to render with regard to that topic?

A. Well that -- that some of this was tied to a

testing program of one type or another, biological testing program, some of which we've discussed, which is the mouse skin system and fractionation identification of compounds in response to the early publications of Dr. Wynder. Speak generally in terms of the Lorillard effort and the numbers of compounds that were identified and published in published material, part of which I think is attached to my curriculum vitae. Some of the efforts that were going on historically when I came into the company with Farmer Research Foundation on the same subject. And methods of development of isolation/identification of compounds, including early efforts on benzpyrene and then later efforts on phenol. Talk about the ciliary activity as another bioassay system and the work that was done there with respect to identification of compounds that may be playing a role in the ciliatoxicity in the assay systems that were being used, and ultimately the conclusions that we reached with respect to that work.

Q. You mentioned a number of, what I will refer to as factual things relating to the chemical analysis efforts that were ongoing. My question is: Based upon those things, do you intend to render opinions

about anything relating to that work that was done?
A. Opinions on the final significance, I think, on the --
Well the significance of the work, I guess is the best way to put it, with respect to the assay system and our conclusions with respect to any possible implications with respect to the human system.
Q. All right. What in --
With particularity, now, what opinions do you expect to render at trial with regard to that?
A. I would render an opinion on the cilia -- ciliastatic components of cigarette smoke that we investigated, identified, concluded certain things with respect to the assays that were being used and developed. And I -- I -- I don't know that I will, but I can describe those assays that Lorillard conducted internally. I can describe the assays that Lorillard conducted externally through consulting relationships with a Professor Dahlamn, principally, and also a Professor Rylander. Their assay system, their conclusions, some of the dichotomies that existed, and then the final conclusions involving work on oral absorption of compounds and recognition of the fact that these -- these materials really did

not appear to be getting into the lower respiratory tract of the humans because of such a high water solubility and affinity in the oral cavity, particularly those that were most ciliatoxic in some of these assay systems. I would also indicate that that work was confirmed by the Tobacco Working Group, of which I was a part.

Q. Again, you've -- you've mentioned a number of factual things that occurred, but I'm still not certain what opinions with regard to that work you intend to express.

A. That the ciliatoxic assays in vitro do not represent and cannot be extrapolated to the human being. That one must take into account absorption in the upper respiratory tract of the smoker, which these systems did not do, and therefore they led to false conclusions regarding whether or not agents were indeed ciliatoxic in the human system. And the reason that the dichotomy existed, as I said, these in vitro systems did not have upper respiratory tracts or oral cavities where we found that many of these ingredients were almost a hundred percent absorbed.

Q. And when you say they were absorbed, they were absorbed where?

A. In principally the oral cavity.
Q. And the bloodstream?
A. Well I don't know where they went, but they didn't reach the cilia.
Q. Is that, not knowing where they went, is that a function of not having followed that research through to the end?
A. No, no. The --
They would enter the general system of the individual and be excreted either directly or as metabolites.
Q. Any other opinions that you intend to offer with regard to the sort of work that was done?
A. Well what I did not cover is -- yet is the work that was done with a compound that we called PMO, phenylmethyloxydiazole, which was thought to be a compound that was protective in the respiratory tract of animals. And again, we pursued this compound in terms of its possible practical application to tobacco. However, the long-term chronic inhalation study in dogs which was done by the Tobacco Working Group incorporating this material did not show any -- any prophylactic effect, I should say, on the respiratory tracts of the dogs, and we dropped this after considerable investment in looking at this

material as a potential prophylactic with respect to the defense mechanisms of the respiratory tract.

Now I'm talking again about cilia, I'm talking about the macrophages and their activity, generally irritation of the -- of the respiratory epithelium.

Q. If I understand what you're saying, then, the work with PMO as an additive to make the cigarette smoke safer or less toxic proved not to be successful?

A. In terms of chronic exposure in animals. It was -- always showed up as positive with respect to these in vitro short-term animal studies.

Q. And as a result --

A. And again, more -- more work in response, I think, to some of the accusations and theories that were developed with respect to cigarette smoke.

Q. And as a result, if I understand what you're saying, PMO did not get added to cigarettes commercially?

A. That's correct.

Q. Any other opinions that you expect to render with regard to the long-term historical chemical-analysis work that was done by Lorillard?

A. I believe those are the principal ones that I -- occur to me at the moment.

Q. You also mentioned testimony, opinion testimony on disease causation in a scientific sense.

A. Yes.

Q. What opinions do you expect to render with regard to that subject?

A. The --

What I regard as the key missing elements with respect to proof of causation of disease and cigarette smoking, and the elements that are inconsistent with a scientific proof of this, and much of that rests in the inhalation research that's been done. And I will discuss the development of inhalation models, the objections that were voiced with respect to inhalation animal models, regarding deposition of material and quantities of material in the respiratory tract of animals, and actual -- our actual efforts to quantitate what the respiratory tract exposure was to these animals, demonstrating that it was quite substantial, that it was in the range, certainly, of heavy human exposure on a -- on most of the bases that you could calculate it; in other words, on the basis of animal weight, on the basis of the lung weight, on the basis of lung surface area, that sort of thing. A general comment, I guess, on the full development of that activity and

the general results in animal studies that have been done, which is no significant tumors against the control of the type found in human beings in response to lifetime exposures or near lifetime exposures to tobacco smoke. And where there were reports in the literature, for example, by Dr. Auerbach and his dogs, a repeat of that kind of study and its failure to replicate some of the claims that he made in the first study. That sort of thing, to basically talk about basically inhalation work and the lack of response, a tumorigenic response by the animals to inhalation of cigarette smoke, a lack of any plausible reasons as to why this is so. If tobacco smoke is indeed a carcinogen to the human being, it should be so to animal strains that are sensitive to the development of lung tumors, and have been shown to be so with specific animal carcinogens.

Q. With regard to animal inhalation studies, did Lorillard perform such studies in-house?

A. Lorillard performed short-term studies in the methods development of -- of machines for exposure purposes, short-term exposures to determine levels of deposition in the respiratory tract of animals and where in the respiratory tract of animals the deposition was occurring. Beyond that I do not

believe that we conducted any -- any significant exposures in-house. We may have looked briefly at something, but nothing beyond what I regard as short-term, very short-term exposures.

Q. What role did you personally play in the in-house Lorillard inhalation studies?

A. I supervised the work, participated in developing the analytical methods for making determinations of deposition, deposition in animals. These, again, have been published as papers, the results of that work, and were provided to other investigators who have used the methodology.

Q. Are those papers that you authored, in part?

A. That's correct.

Q. Are those papers that you intend to rely on for your opinions in this litigation?

A. I would rely on all of them, yes.

Q. These are a group of the articles that were provided as the articles upon which you intend to rely for your opinions. Can you take a look through those and tell me which ones of those relate to your opinions on the animal inhalation work?

A. The deposition?

Q. I'm sorry?

A. The deposition? The amount of smoke deposited

in the animals?

Q. Yes, if -- if that's part of it. If there are --

If there are any that relate to the animal inhalation work and your opinions with regard to that at all, I'd like you to tell me which ones those are.

A. I won't look through here, but I can look through my publications, would be quicker.

Q. And that is an index of all of the articles that are attached; correct?

A. I don't know that to be the case, but I would presume so.

Q. Okay.

A. "Dichlorbenzophenone a Nonradioactive Tracer for Cigarette Smoke Gas Chromatographic Analysis of Tracer." And that's in American Review of Respiratory Diseases.

Q. Okay.

A. And the second one is "Cigarette Smoke Tracers: Gas Chromatographic Analysis of Decachlorobiphenyl." Same -- same journal.

And I am the last author on both of those. Those are the two that relate to amounts of particulate being deposited in the respiratory tract of a -- of a variety of experimental animals.

Q. Okay. Are there any others that relate to opinions you intend to render with regard to smoke -- animal inhalation smoke testing in any other aspect other than deposition?

A. I don't -- I don't think so, but the -- some of the ciliary work is -- is here, and I would certainly rely on that in -- regarding some of my comments there.

Do you want the names -- the list -- do you want me to --

Q. This would --

These would be the articles in which you have participated as an author --

A. Yes. I'm -- I'm an author on all of these.

Q. -- relating to the ciliatoxicity area that you talked about?

A. That's correct.

Q. Okay. Which are those?

A. "Difference in ciliatoxicity of Cigarette Smoke: Comparison of Two Exposure Methods." Again, American Review of Respiratory Disease.

This is not a publication, it was a presentation at a scientific meeting, "An In Vitro Technique for Studying the Ciliastatic Properties of Solutions, Gases, and Aerosol."

I think those are the two.
Q. And those both relate to the toxicity of smoke particulate on cilia as opposed to PMO work on cilia?
A. That's correct. That's correct.
Q. Are there articles you have written that you intend to rely upon for any opinions with regard to the PMO work?
A. None that I have written as I recall, but virtually all of those were authored by either and/or -- Professor Dalhamn and/or Rylander. They would not appear in my curriculum vitae.
Q. Are there any --
A. Although I see they are joint authors on one of these papers with me, and it's possible there's something in that particular paper on the PMO. I don't know.
Q. Are there any other opinions that you intend to render with regard to the causation of disease in relation to cigarette smoke?
A. Well I will -- I will give my opinions on, of course, mouse skin-painting as an assay and its particular shortcomings with respect to human disease.
Q. What opinions do you intend to render with regard to that?

A. That I do not believe it can be extrapolated to the human being; it's too remote, has too many problems. It doesn't respond even to carcinogens of a particular type. It principally -- well I will show some of the dichotomies, I guess, between that assay and some of the mutagenic assays, which are also in vitro assays. They are in vitro assays, but they give different results in many respects than the skin-painting with respect to cigarette smoke. They are also remote and are not -- they don't produce tumors, but many scientists would be of the view that there is a relationship between mutagenic activity and tumorigenic activity, although not a -- a clear one-to-one relationship. All mutagens are not carcinogens, in other words. On the other hand, you don't expect to see differences between skin-painting and mutagenic assays unless there is a problem with one or both of the assays.

Q. Anything else with regard to opinions you intend to render on mouse skin-painting?

A. No, that -- that would be it.

Q. Are there particular publications that you intend to rely upon as the basis for your opinions on mouse skin-painting?

A. Principally my experience, the Tobacco Working

Group program in working with that assay system and seeing the problems associated with it throughout all of these years in reviewing data that was produced under various studies that are using mouse skin.

Q. What work did you personally do with regard to the Tobacco Working Group assays?

A. I reviewed all the data coming out of the assays. And a --

For example, some of the problems is that you don't always get a dose/response. If you apply cigarette smoke condensate in two doses, one lower than the other, frequently the higher dose gives you less response than the lower dose. There's a very narrow window in which you can get what appears to be a dose/response, but it's a very, very narrow window and may not always -- may not apply to different types of condensate that you're using in the assay. Those kinds of issues.

Q. Have you designed --

A. Trying to -- trying to interpret the results from a mouse skin assay.

Q. Have you designed any mouse skin assays yourself?

A. Do you mean did I participate in the design of the experiment --

Q. Yes.
A. -- or decide what would be painted and that sort of thing?
Q. Yes.
A. Yes.
Q. And what work did you do there?
A. Well some of it we talked about: the isolation of different fractions and how they would be assayed by Homburger, for example. This was under my direction and supervision and planning. I certainly participated in what many of the experiments would be through the Tobacco Working Group in that the tobacco companies were the ones who were asked to provide the cigarettes or variance in cigarettes which would be used to generate the condensate for the skin-painting in that program.
Q. What planning role did you have in the Homburger work?
A. How many animals we would use, what the controls would be. If we were using an initiator, what the initiator would be. These are all planning activities. Whether you would accept the strain of mice that was being proposed or whether you wanted two different strains. All deliberations in the mouse skin-painting, what -- what strain of animals

are you going to use.

Q. And how did you arrive at the decision as to which strain of mouse should be used?

A. Generally based upon the literature and what other individuals had found, that a mouse was sensitive to chemical carcinogens. In almost every instance you would pick the one which was most sensitive unless it was complicated by the fact that they -- they had a lot of spontaneous tumors, which meant your controls would be high and therefore you would have more difficulty in distinguishing between the control and the test. These are some of the considerations.

Also the expected life-span of the animal, was it consistent with the best expectation of getting tumors. You don't want the animals that die of some other complications other than tumors at an early age. Of course you want an animal that is genetically defined, genetically stable, so you can repeat the experiment with future animals and expect to get a similar result, not one that varies by the susceptibility of the animals. Those are some of the things that go into the considerations as to what animals you will choose. Of course the availability of the animal is the number-one criteria --

criterion.
Q. Who all worked on that project with you?
A. Who all worked on which project?
Q. The mouse skin-painting.
A. Which one?
Q. How many were there?
A. There were many experiments with Homburger, there were many experiments within the Tobacco Working Group, and I -- I'm not sure I understand the question relative to that activity or those activities.
Q. Well did the activities you've just described with regard to the strains-of-mice selection and that sort of thing, was that your role on every one of those projects?
A. I contributed to that. Wasn't my role solely, no.
Q. And that's my question, I guess, whether you need to do it project by project or overall, but who worked on the project with you? Are you --
Did you have biologists, for example, to work on the project?
A. Depends on point in time, but in the Tobacco Working Group, for example, we had individuals on that who had a lot of experience of their own.

Wynder was one, for example, who was a member of the Tobacco Working Group. Bock was another, who was an individual who did a lot of skin-painting. As I said, I had considerable experience in looking at the results of other laboratories, and I can't detail the exact sequence of events, but through discussions it was agreed that a certain strain of animals would be used.

The -- the laboratory that was doing -- who won the contract to do the work under the Tobacco Working Group certainly had scientists who also had opinions and would have been involved in the decisions, as well as the employees of the National Cancer Institute.

Q. And the team that worked on any one of these -- and maybe we could focus on just one. How many team members were there for one of these mouse skin-painting tests?

A. It wasn't a team, but obviously somebody had to make the cigarettes, there had to be specifications agreed to as to what the cigarettes would be. Lorillard manufactured many of the cigarettes for the Tobacco Working Group, not all, but some. Then somebody had to define the protocol that would be used for smoking those cigarettes to get large

amounts of smoke condensate for the skin-painting work. I participated in that protocol in that we had been probably doing that as long as anyone in terms of generating large amounts of condensate. One would -- one defined the procedures and protocol in terms of getting this into a state where it could be used to -- for application to the animals. Again, I was a participant in that with respect to the Tobacco Working Group. As I recall, I did not participate in the protocol as application to the animals nor how the animals would be housed. That was with the contractor and the NCI staff.

So it wasn't a team, but a large group of participants in setting up these experiments within the Tobacco Working Group. And then within Lorillard, when we were doing work with, for example, Homburger and supplying materials to Wynder, we would have people doing the same kind of things within our organization. But not a -- a team. We had people whose specialty was in our pilot operations to produce sample cigarettes, and other people who conducted analyses to see that they met the specifications. So large numbers of people, but not a hundred percent of their time devoted to these kind of projects.

Q. What kinds of disciplines did these people have inside Lorillard?

A. Well over time we have had chemists, we've had physicists, we've had toxicologists, pharmacologists, we have employed as consultants M.D.'s. We have not had an M.D. on staff. Those are the disciplines that I -- I remember.

Q. And which of those participated in the mouse skin-painting experiments?

A. Well I'm not sure I can recite them all, but there are still skin-painting experiments going on, and there are biologists involved, toxicologists involved; principally in what we call the life sciences area, and the backgrounds there are toxicology and biology.

Q. And those are in-house people?

A. Those are in-house people.

Q. Is that work going on today?

A. There is work going on particularly with respect to ingredients.

MR. NORTHRIP: When it's a convenient time, we've been over an hour, so why don't we take a break.

MR. FINZEN: We can take a break now.

THE REPORTER: Off the record, please.

(Recess taken.)

BY MR. FINZEN:

Q. Have you now given us all of the opinions that you intend to render with regard to your view on causation and disease?

A. In terms of causation. Well I'd respond to any question that I'm asked that falls within my area of expertise, but I think I have generally covered the area in terms of what I would testify to.

Q. With regard to what you consider to be your area of expertise, what -- what is that?

A. My expertise is a tobacco scientist relating to all areas of tobacco, tobacco use, tobacco assay systems, chemistry.

Q. You next mentioned opinions regarding the NCI as a technical advisor to NCI.

A. Yes.

Q. What opinions do you expect to render with regard to that?

A. Discussion of the program and the -- the nature of the work under that program and the concluding -- conclusions reached as a result of a little more than 10 years of activity with respect to attempts to modify cigarettes relative to the bioassay systems that were employed.

Q. Modify cigarettes in what way?
A. Well there were a large number of variables tested. I'm not sure I can discuss all the modifications just spontaneously, but there were many modifications -- attempted modifications at modifying the filler. There were some assays conducted on what was reported to be improvements with respect to mouse skin bioassays, and that would include, I think, a claim by Liggett & Myers that they had discovered something that would alleviate activity on mouse skin. There was work along that line within the Tobacco Working Group activity. Some of the filter designs, potential filter designs were looked at, different types of tobacco, with flavors, without flavors, with certain kinds of flavors, reconstituted sheets, different types of reconstituted sheets, specially modified sheets for the program, porous paper, not so porous paper, ventilated filters, not ventilated filters. These are some of the kinds of variables or some of the variables that were looked at in that program over time.
Q. All aimed at trying to find a less biologically active cigarette?
A. With respect to mouse skin and with respect to inhalation. Although there was not an inhalation

model developed, there were inhalation studies conducted. There were attempts, for example, to build on Auerbach's work with the beagle dog in terms of an inhalation model, and there were long-term studies conducted with cigarettes in that model. There weren't any differences in the cigarettes and almost no effects by the cigarettes on the animals.

Q. Were --

A. Or cigarette smoke.

Q. What do you mean there weren't any differences in the cigarettes?

A. The cigarette series, I believe, was different alkaloid levels, I think there were maybe three alkaloid levels, and there was also the phenylmethyloxydiazole was one of the variants, and that pathology that existed indicated that there was very little pathology in the animals independent of what the variable was.

Q. So the NCI program was both with regard to a safer cigarette, and trying to do inhalation studies with regular cigarettes?

A. No, these weren't regular, they were specially grown tobaccos, as I recall, that had different alkaloid levels, different nicotine levels, experimentally grown at the University of Kentucky

and I think the University of North -- North Carolina -- North Carolina State University through their experimental programs. I believe those were the samples, although I can't be sure. But one way or another, there was constructed, I think, three different cigarettes with three different levels of -- of nicotine, principally, --

Q. And the --

A. -- in the tobacco.

Q. The purpose of the study was what?

A. To determine whether or not there was a difference in response in the dog by inhalation to the different levels.

Q. Of nicotine.

A. Of nicotine.

Q. This was not looking for creation of disease in these animals?

A. Oh, sure, certainly. This is inhalation.

Q. Well that -- that's what I'm --

That's what I'm trying to find out. You talked first about all these different ingredients and mouse skin to -- to determine whether there were ingredients that could not develop tumors in mouse skin.

A. That's correct.

Q. That was work to try to find a so-called less biologically active or safer cigarette?

A. And -- and if something would have come out of that work, then the intent was to go to an inhalation model --

Q. Okay.

A. -- to see whether it could be verified.

Q. And then separate and apart from that there was inhalation work that wasn't necessarily looked at --

A. Well --

Q. -- for purposes of a safer cigarette.

A. The -- the belief was that the only inhalation model that might work was the one that Auerbach had reported in the literature and claimed to find tumors on inhalation of tobacco smoke in these animals. So this was activity that went to Auerbach and provided the funds for him to set up this work with the dog as the animal and these variants, A, to determine whether there's a difference in the variants, if we got a -- if there was a response, and B, to validate his earlier studies that you do get a tumorigenic response in the beagle. And the result was there were no tumorigenic responses in the beagle in this study, which was only different in the -- in some of the apparatus used to expose the dog. This -- this

was a much less stressful apparatus or exposure regime to the dog, that being the only difference, and a general failure to find any really significant pathology other than, I think, some hyperplasia in the animals.

Q. In the second Auerbach study, how was the measure of smoke that the dogs actually drew into their lungs made?

A. I believe --

There were different assessments, but these are dogs that are tracheotomized, and the smoke goes in through the trachea.

Q. In both the first and the second?

A. Both in the first and the second. In the first the procedure was to simply stick a lighted cigarette into a cuff that was in the tracheotomy, and the dog's breathing puffed the cigarette. In the procedure that was adopted -- and this was a very stressful situation to the dogs in his -- in his first reported experiment. In the latter experiments conducted in the Tobacco Working Group, generated -- a machine generated the puff into a standing tube and then the dog inhaled it, again through a tracheotomy, but in more intermittent way than just when he was trying to breathe. The amount of smoke that the dog

got was compared, I think, in both methods, and the exposure methods were comparable in terms of amount of deposition in the animal, that sort of thing.

Q. Over a similar length of time?

A. Yes. I've forgotten the exact timeframe, but I believe these animals were exposed for a number of years. The experiment was terminated with the termination of the National Cancer Institute support for the Tobacco Working Group program.

Q. What is your opinion going to be with regard to why the dogs in the more stressful situation, smoking the cigarettes directly through the tracheostomy, did show signs of cancer, while the second group of dogs did not?

A. Well there are a number of possible explanations, I don't know which is valid, but the tumors could have arisen because the dogs were infected with viruses in the first occurrence. It could have been the result of the extreme stress to which the dogs were subjected rather than the smoke exposure, is another possible explanation. And I guess, third, although the tumor numbers were very small in the first experiment, they could have been artifactual, not repeatable, for unknown reasons.

Q. Do you intend to render an opinion with regard

to the validity of the Auerbach dog study that found tumors?

A. That it can -- could not be confirmed, yes.

Q. Okay. You intend to render that essentially factual observation, but do you intend to render an opinion about the validity of the first study?

A. I would consider the first invalid in that it had a lot of deficiencies that there were attempts to correct. It -- they both were conducted by the same investigator, so it wasn't an investigator difference, and he used the same pathologist in both cases, so again it wasn't the pathologist that was the difference. I would -- I would simply say that the first was a limited experiment which cannot be confirmed, and therefore should not be -- it cannot be considered valid.

Q. Okay. So your opinion, then, will be that the first Auerbach study is not a valid study, and the basis for that opinion is that it wasn't replicated?

A. Cannot replicate it.

Q. Any other basis for -- for that opinion?

A. No. Not --

Not only that it wasn't replicated, but it wasn't replicated by the same investigator.

Q. Any other opinions you intend to offer with

regard to animal inhalation studies?
A. Well I think I have generally covered the area that --
I don't believe there's any animal inhalation study that has produced tumors of the type found in -- in man, and that is one of my principal dichotomies with the causation theory, that smoking has been a proven cause of lung cancer in human beings. There is no obvious reason as to why these models, inhalation models are not yielding tumors. The dose -- the dose --
I can demonstrate through data that we have generated that the dose is there, that the animals are sensitive, and, if anything, should be more sensitive than the human being, many of them in terms of the breeding to breed in sensitivity. So yes, I will opine on materials of that nature.
Q. What is the evidence you have to support your belief that the dose is there for the animal inhalation studies, sufficient dose?
A. I -- I thought I covered that. I said that our studies using tracers that we could measure in -- in small quantities in the respiratory tract of the animals. I pointed out two papers in my curriculum vitae of tracers that were used for that purpose.

There have been others used by other investigators, including Carbon-14 labeled radioactive materials that are shown to behave as cigarette smoke when incorporated in a cigarette and measures of deposition have been made with those. For example, Oak Ridge National Laboratory has -- was a participant in all of the Tobacco Working Group activity, and they made measurements of deposition in dogs and another set of animals that were used for inhalation purposes under that activity. So the methods were developed to measure deposition, and deposition has been measured, and it's -- it's quite substantial relative to deposition in the human being.

Q. How -- how many of those experiments that have been done with animals in inhalation studies have had deposition measured analytically in the way you're talking about?

A. In the more recent studies, that measure has been made.

Q. How many is that?

A. Well there have been a lot of inhalation studies in the past which were a relatively few animals and very crude methods of exposure and assessments, so discounting those and dealing with inhalation

experiments that -- where the animals were carefully housed and free from disease and other agents such as viruses and bacteria, there have been relatively few of them on a large scale, but one of them certainly was the Tobacco Working Group dog -- dog work. There have been a number of rat experiments, rat inhalation work. There have been mice -- mouse inhalation work, one of those by The Council for Tobacco Research, which was a very large study in terms of number of mice. And of course Lorillard has continued to do inhalation studies of a -- not lifetime type, but 90-day studies with respect to additives, cigarette additives, and we've never seen any significant pathology beyond hyperplasia and some metaplasia in the animals' respiratory tracts over the years. There have been some hamster studies, but here again, the hamster has never, to my knowledge, produced tumors of the type found in the respiratory tract of the human being.

Q. How many reported studies are there with measured deposition of the smoke inhalation in laboratory animals?

A. I don't know that I can recite all of them, I can recite some at this point.

Q. Are there some that you rely on in particular?

A. I would rely on the deposition in the CTR study that was done. I would rely on the deposition in the Tobacco Working Group studies. This was done in both the dog and in -- in rats. I would rely on Lorillard's determination --

Q. Published?

A. -- throughout --

Well the methods were published.

Q. I'm asking now for studies where the results were published.

A. Well -- well --

Trying to get to that. We have a whole series of experiments in terms of 90-day exposures where measurements are made, and there is a paper which I believe has been submitted for publication now covering a large number of those experiments --

Q. Is that in the --

A. -- we have published, detailing, I think, the protocol for these -- some of these kind of studies. Or we are publishing, maybe, or have -- I believe we are publishing.

Q. Are all of the --

A. Those are the ones that come to mind right now. The deposition or other direct measure of exposure has been carried out once a correlation between

deposition and the other measures were -- measure has been shown.

Q. Are those studies on which you intend to rely, where the deposition of the smoke and the animals has been measured in the way that you described earlier, listed among the articles that you have produced as those upon which you're relying?

A. I don't know. I haven't looked.

Q. Would you take a look, please, and tell me which of the articles --

A. I think these are, I presume, my published articles. Is that -- I don't know. I can't --

I can't give you every article on which I rely without bringing you a huge volume and a lot of time looking for.

These are my publications.

Q. Have you produced the written studies and published studies that you intend to rely upon in the area of smoke inhalation for your opinions as part of your expert report?

A. Have I published --

Q. No, have you produced the --

A. No. Well I don't know. But what I see here are my authored publications.

Q. Okay.

A. I don't think we have produced the reports from the Tobacco Working Group, that sort of thing. I don't think we would have produced the publications from Oak Ridge National Laboratory on their studies. I don't think we produced a copy of all CTR inhalation experiments. But as I say, to me this is a somewhat unreasonable request --

Q. Well --

A. -- to ask someone to produce everything that they would consider as an experiment on inhalation.

Q. I'm asking so that we can, in anticipation of trial, in order to prepare for examination of you at trial to be able to read the articles that you intend to rely upon in support for your opinion, and that's the reason I'm asking you now.

Which are those studies that you rely upon where the deposition of the smoke in the animals in the inhalation studies was measured and, as such, related in some way to a reasonable amount of inhalation for a human being?

A. And I've listed those as I recall them today.

Q. All right. Any other opinions that you expect to offer with regard to the NCI work?

A. Just the general conclusions, work which is to be found in the final reports and the reports of that

group.

Q. The next topic that you said you would have opinions on are the allegations regarding nicotine manipulation and spiking and ammonia technology and other additives.

A. That's correct.

Q. What opinions do you expect to render in those areas?

A. Well with respect to nicotine I would describe some of -- rely upon Lorillard's work in this field, our general understanding. I would rely, for example, on data that we have generated over the years that indicates tar and nicotine, a determinant is the particular blend of tobacco that is used. In both tar and nicotine yield, in terms of the nicotine-to-tar ratio, that the blend is one determinant of that. That the diammonium phosphate that we employ does not affect -- in our measurements does not affect the tar-to-nicotine delivery except by increasing the puff count some -- in less than one puff count under the FTC testing procedure, that the ratio is not affected. That the transfer of -- of nicotine from tobacco rate is unaffected over a range of application of diammonium phosphate which exceeds the level that we have ever employed in the

manufacture of cigarettes and today employ. That when you talk about very low tar/nicotine cigarettes such as the Kent III and the Triumph, the yield of nicotine and tar is determined by a multitude of variables. The ratio of nicotine to tar is determined, in part, by the blend that's used, also the air ventilation system increases the yield of nicotine relative to tar because of the ventilation system itself and the --

I can describe the mechanism by which this occurs. Also can describe other compounds that are affected by ventilation systems that are unaffected otherwise. This will include carbon monoxide. So I will generally provide my opinion as to what effects these ratios, the tar -- I'm talking about nicotine to tar, what effects the yields of these ingredients with respect to additives that may be employed, and certainly those employed by Lorillard. The conclusions will be those that I've indicated.

MR. MONICA: Bruce, may I just take a second? Just planning for the rest of the day, should I plan to have Mr. Preddy here this evening, or do you think we're not going to get to him?

MR. FINZEN: It's ten to 4:00. If we're going to conclude at 5:30, probably not. And might

just as well have him come tomorrow.

MR. MONICA: Would you like to start with him, then, in the morning, first --

MR. FINZEN: Sure, that would be fine.

MR. MONICA: Okay. Then we'll just plan on that.

MR. FINZEN: All right.

MR. MONICA: Thank you.

BY MR. FINZEN:

Q. With regard to the pH studies that you referred to --

MR. FINZEN: Off the record a second.

THE REPORTER: Both?

Off the record, please.

(Discussion off the record.)

(Plaintiffs' Exhibits 1255 through 1257 were marked for identification.)

BY MR. FINZEN:

Q. Sir, I'm showing you or handing you now what's been marked as Plaintiffs' Exhibits 1255, 1256 and 1257. 1255 is a memorandum on Lorillard -- Lorillard letterhead dated July 24, 1996 from J. M. Johnson to M. A. Sudholt bearing Bates stamp numbered 88029439 through 88029460. 1256 is a memorandum on Lorillard letterhead dated September 18, 1996 from J. M.

Johnson to M. A. Sudholt bearing Bates numbers 89291533 through 1545. And 1257 is a memorandum on Lorillard letterhead dated March 1, 1996 from R. T. Walker to M. A. Sudholt bearing Bates numbers 89802438 through 245.

Have you seen these documents before?

A. Yes, I have.

Q. When is the first time that you saw these documents?

A. Shortly after the work was completed.

Q. So in each case, shortly after the date that appears on the exhibit?

A. Correct.

Q. Who --

Who is M. A. Sudholt?

A. She is a chemist in Lorillard's research facility.

Q. Does she have a particular position or title?

A. She is, I believe, manager of analytical development.

Q. And who is J. M. Johnson?

A. She's a chemist who works under Sudholt's supervision.

Q. And R. T. Walker?

A. I believe another chemist working under

Sudholt's supervision.
Q. Each of these exhibits bear an internal memo number at the top of the page as well. Exhibit 1255 is internal memo number 4524. Do you know what that internal memo number refers to?
A. I'm not a hundred percent sure, but I believe it may refer to a number by which we index reports in our library.
Q. Do you know what the origin was of the work that is reported in each of these -- how -- how the work was -- was scheduled or ordered?
A. Well the work followed, I guess, a series of accusations by Dr. Kessler that these kinds of compounds affected the free nicotine and the absorption or bioavailability of nicotine. (Coughing) Excuse me.
Q. When were the allegations or accusations made by Dr. Kessler that occasioned this work?
A. I believe in 1994.
Q. And was there a program in response to that that was initiated within Lorillard?
A. Not a program. There -- this is the work that was initiated.
Q. Did this work become known as some sort of a project? Like we have seen memos that related to the

nicotine augmentation project, did this work have a project name?

A. The only thing I see here is project number Q 449, which is "Analytical Support," indicated on the document.

Q. And where are you looking --

A. On both of them.

Q. -- to see that?

A. It says "PROJECT NUMBER," right under "SUBJECT," "Q 449 Analytical Support."

Q. Does that term "Analytical Support" have any meaning that's unique to this particular project?

A. No. It means that's where the people's time was charged for accounting and budgetary purposes.

Q. Okay. What does the Q 449 refer to then?

A. A project number, which is a budgeted project for so much activity in terms of man-hours under the general subject of analytical support.

Q. These three memoranda that span the time between March 1 of 1996 and September 18, 1996, do they constitute all of the written work that came out of project Q 449?

A. No. Project Q 449 could certainly include materials other than related to this subject.

Q. Is there any unique identifier, then, that would

identify work that was related solely to this particular subject dealing with a response or -- or research efforts in response to the allegations of Dr. Kessler?

A. No, not that I'm aware of.

Q. Do these three memoranda constitute all of the written work at Lorillard or inside Lorillard relating to the research effort to respond to the allegations made with regard to the effect of pH by Dr. Kessler?

A. It certainly would not include sample sheets for the preparation of these materials, which would have been written. There -- there may be other individuals involved in some sort of a communication surrounding this activity for which written materials were generated, but I -- I have no first-hand knowledge of what those materials are, I simply suspect they would exist.

Q. Do you know as you sit here today whether or not there are any other memos that report findings, as these three memos purport to do, related to research work done in response to the allegations made concerning pH by Dr. Kessler?

A. Well we covered memos the other day that you have that have been produced by Lorillard that may

have had something -- something about diammonium carbonate in them. I don't know. I think I recall that they did. Aside from that, I know of no other documents other than these which would have any substantial bearing on the subject.

Q. All of those that you're referring to were dated substantially earlier in time than these three memos; correct?

A. They were dated whatever the production date was prior to that.

Q. Okay. I'm -- I'm now focusing on the period of time from whatever the date of Dr. Kessler's allegations, which you believe was sometime in 1994, until today. Are you aware of any other internal memos at Lorillard that report findings of research done in response to Dr. Kessler's allegations other than these three memos that are Exhibits 1255 through 1257?

A. Not that I'm aware of.

Q. What is it about these particular research findings that leads you to believe that the diammonium phosphate that is added by Lorillard has no effect on the pH of the tobacco smoke that is delivered from Lorillard cigarettes?

A. Well the easiest place to look is in one of the

graphs, which is Fig. 1 of the 1255 exhibit.

Q. All right.

A. And this shows the effect on pH with different additive levels on the tobacco for four different additives. Diammonium phosphate is the one abbreviated as DAP, carrying the symbol of the upside down triangle, and that is the lower plot. And there would appear to be essentially a constant pH across levels of addition of the additive. I conclude from that that the additive has no effect on pH of smoke as determined by the method that we used to measure pH, which is that of measuring the pH of the particulate matter.

Q. Was there a control cigarette without any additive against which the pH was measured for the cigarettes with additives?

A. I think the cigarettes all had the reconstituted sheet, so the lowest level of DAP was point -- well no, zero in this plot, I guess. It's plotted as zero, but I'm unsure. Shows 0.5, 1.5 and 2 as points in the plot.

Q. And do you know whether zero means that there was the normal reconstituted sheet with the normal amount of DAP, or whether it means there was reconstituted sheet with no DAP?

A. I have to go back and look. I don't --

See what it says.

Well it says the control additive was applied at .4, the control, which suggests that the reconstituted sheet was present. That would be the level of contribution from the reconstituted sheet.

Q. At zero --

The zero marking would be?

A. The zero, I believe, should be .4, based upon the experimental discussion on page two. For the other additives, the control was zero. That -- that's the way I would interpret it.

Q. Then trying to extrapolate that to the graph, at the zero mark on the horizontal axis, then, of -- of Fig. 1, that represents .4 DAP in the -- in the cigarette?

A. That would be correct.

Q. Do you have any idea what the smoke pH would be if there was no DAP?

A. Unchanged.

Q. What do you mean "unchanged?"

A. The same --

It doesn't change with any level of addition. Doesn't --

Q. And you -- and you interpret from that --

A. There is no trend of pH with increasing levels of addition, whereas you see a trend of increasing levels of pH with addition of the other additives.
Q. And from that you assume that if you had zero, the level would be -- the pH would be the same.
A. Yes.
Q. Can you explain why it is that the other three additives were tested against a control that had none of the additives in them at all, while DAP was tested against a control that had a baseline of .4 percent added?
A. I believe because we don't use the other additives, and the other additives example would have also included a .4 DAP.
Q. Do you know that for a fact --
A. Well --
Q. -- as you read it?
A. -- again looking at the experimental, it says "were made with certain constructions," and if they were made by construction with those type of tobacco blends, then it would have included the reconstituted sheet.
Q. I note that the three additives that you've testified are not included within Lorillard's cigarettes were tested against one brand of

cigarette, the Old Gold 85, and the DAP was tested against a Newport 85 construction. Do you know why that is?

A. No.

Q. For scientific certainty, if you were testing the effect of four different compounds and addition of amounts, incremental amounts of those compounds, wouldn't it make sense to test them all against the same underlying cigarette construction?

A. May have been done --

Samples may have been prepared at two different times, but that's the only explanation that may -- occurs to me as a possibility. But no, I would certainly not think that the effect of any of these additives was blend-specific, but rather they either would or would not have effect on nicotine.

Q. Is there any support in here, in the report of the experiment, that you can find for that last statement you just made, that the effect of any of these additives was not blend-specific?

A. Well there's an earlier report that also has diammonium phosphate. I assume it was a different blend. The results are similar.

Q. What are you referring to now?

A. Oh, I'm referring to 1257, puff-by-puff pH

comparison, Fig. 1 of this report. One level of addition -- again the control is a .4 percent. It happened to turn out in this case that the control with little addition had a slightly higher pH than the additive sample at three percent.

Q. And what was the blend that this was added to in this particular study?

A. Well it's done at a different point in time, so it would not have been the same tobacco regardless of which blend, or it would not have been the identical tobacco.

Doesn't say. Just identified as a sample number, 1411 and 1412.

Q. And what conclusion do you draw from the results of the study in Exhibit 1257?

A. There's no effect on --

There's no effect of elevating the pH.

Q. No effect in elevating the pH by what?

A. By diammonium phosphate.

Q. By increasing amounts of diammonium phosphate?

A. Yes. Yes.

Q. Again here they do say that the -- both the control and the sample were made from RL that had the diammonium phosphate included within it; correct?

A. It's shown as a .4 percent control.

Q. Right. My --

My question is: In relation to the control, is there a test that shows what the pH of the smoke is where there is an RL with no diammonium phosphate, zero?

A. Not in these reports, no.

Q. Is there a such a report at Lorillard that you're aware of that shows the pH of the smoke of a Lorillard cigarette with no diammonium phosphate added?

A. Not to my knowledge.

Q. As you sit here, do you have any knowledge of such testing having been done at some point in the past such that you would know what the pH level is of the Lorillard cigarette constructed with no diammonium phosphate added?

A. It would vary with the blend of tobacco, but other than that there's no indication. And my expert opinion would be that these data indicate that there is no effect on pH with the additive of diammonium phosphate.

Q. And you come to that conclusion because when you add amounts above .4, the pH doesn't respond by going up accordingly?

A. That's correct.

Q. And so therefore --
A. Where it does with other additives.
Q. And so therefore it's your conclusion that it does not go up at the .4 level from what it would be if it were zero.
A. Yes. But that's not a very difficult conclusion nor much of an extrapolation. .4 is a very low level.
Q. Would it have been difficult to run the experiment with a control that had zero DAP in it?
A. Not if you eliminate reconstituted sheet. But if you didn't, you'd have to make a special run of a large number of pounds in the process that's used to get a tobacco sheet without any addition.
Q. Well I think for sample purposes in the past hasn't Lorillard, at least at the time that Kimberly Clarke was making RL sheet, had a small RL sheet process for test samples of sheet that they utilized in the lab?
A. Lorillard?
Q. Yes.
A. You would never use that. But no, it's not functional.
Q. You don't --
A. You would -- you would want to use the process

that you use commercially; otherwise, you'd be sitting here telling me that, well, this wasn't the same process and that's the reason you see or don't see a difference. You would -- you would --

If you're going to do it, you would have to do it with the exact process, everything the same except leaving out the diammonium phosphate, and that would be a relatively expensive experiment in that you cannot just produce a few pounds, you would be producing thousands of pounds to get your sample.

THE REPORTER: We have to change tape. Off the record, please.

(Recess taken.)

BY MR. FINZEN:

Q. Sir, looking at Exhibit 1255, which we were looking at before we took the break, you said that the trend of pH with increasing levels of DAP was not there, that the levels of pH did not increase with increasing amounts of DAP; correct?

A. That's correct.

Q. However, the findings of the study generally showed that for all additives, including DAP, cigarettes with the additives had higher values than the control for either filtered or unfiltered in nicotine per cigarette, for ammonium bicarbonate and

diammonium phosphate, nicotine per puff for ammonium carbonate, ammonium bicarbonate and diammonium phosphate, nicotine per CPM for all additives, and it also says as the percent additives were increased, corresponding increases were seen in nicotine transfer from leaf to smoke for either filtered or unfiltered cigarettes on a per cigarette basis for urea and diammonium phosphate in the findings section. Do you see that?

A. Yeah, I see what this says.

Q. Doesn't that mean that whether or not the pH of the smoke increased, the addition of diammonium phosphate did increase the level of nicotine that was delivered to the smoke, meaning that cigarettes with diammonium phosphate would have an increased nicotine delivery to the smoker?

A. What I indicated to you was that the diammonium phosphate causes a reduced burn time of the cigarette, and that the reduced burn time creates some extra amount of a puff, depending on the level of additive, and that this is an increase in nicotine per cigarette. There is also an increase in tar per cigarette. They both increase, relatively speaking, the same amount, so that the ratio of the two remains the same.

This is the same as lengthening the cigarette and getting another puff or increasing the amount of tobacco. This is not what we're talking about as increasing the ratio as the ratio remains the same.

And if I can find the right chart, I'll show it to you.

Q. All right.

THE WITNESS: Oh, I have it back?

MR. NORTHRIP: We have it back.

THE WITNESS: Okay.

A. On the page with the Bates number 455, --

Q. Yes.

A. -- at the bottom, bottom group of numbers, nicotine per CPM is the next from the last.

Q. Yes.

A. And if you'll read across, the DAP control can be read as 7.3 percent nicotine.

Q. Yes.

A. And the next one 0.68, I believe, and the next one 0.68, and the next one 0.75. Those are with increasing amounts of diammonium phosphate. The ratio is a constant. Looks like they're all within easy experimental error.

Q. On the findings --

A. And then --

What I was going to say, then if you look at the same thing on a per puff basis --

Q. Yes.

A. -- you see the same thing, the ratio is staying constant on a per puff basis. So no enrichment of the condensate or tar with respect to nicotine with the DAP additive at varying levels.

Now I'm trying to understand what this finding says.

Q. Turning back to that finding, the finding number three that says there's an increase for both filtered and unfiltered of nicotine per CM -- CPM --

A. Yes.

Q. -- for all additives, do you see that? Wouldn't that normally be read to mean an increase in the nicotine/tar ratio?

A. (Reading Exhibit 1225.) I think that's an error, what they say, because I believe it actually goes down, if anything. It may be statistically significant going down.

Let's see, I want to make sure this -- this is filtered cigarettes we were looking at a minute ago, and filters removed are on the prior page identified as 454, and there in the right columns, and if we look at it, nicotine per CPM, it's the last group of

numbers on the right column.
Q. Yes.
A. And this is per puff, and we see the control running around .073 and then running a .068 for the next group, very close to the same pattern as the filtered cigarette. So there's nothing inconsistent; the ratio is a constant in both cases. The --
Where are the rest of the memos?
(Documents handed to the witness.)
A. This --
The memo that's identified as 1256 is a different summary of the same information in the prior memo, it's just put together in a different fashion in terms of the summary. The findings are stated a little differently here.
Q. So it's your belief that the statement in the finding that the nicotine per CPM was increased for all additives is incorrect.
A. I do. The data do not support that statement. The statement on page seven of this second report on the same data, under "DIAMMONIUM PHOSPHATE," makes the statement, and then it refers all --
The difference is, in this report, everything significant about diammonium phosphate is grouped together as opposed to spread out through the report,

which discuss an effect by all -- all additives at one time.

Q. Which exhibit are you looking at now?

A. I'm looking at 1256. Starting on page seven are the findings with respect to diammonium phosphate. It says the values of nicotine per cigarette, the CPM per cigarette and puffs per cigarette were higher for the cigarettes containing diammonium phosphate relative to the control. That -- that's talking about tobacco nicotine, I believe. Then we get over to page eight, nicotine per puff, nicotine per CPM and nicotine per CPM per puff, "The results seen for these three smoke variables were possibly influenced by the increased puff count and modified burn chemistry caused by the smolder retardant properties diammonium phosphate." With the unfiltered cigarettes, nicotine per puff -- well that's -- that's not one that we're interested in.

Nicotine per C --

Q. For the filtered you're looking?

A. I'm looking down at the last paragraph in the indented section now.

Q. Okay.

A. "Nicotine per CPM and nicotine per CPM per puff for unfiltered cigarettes were either less than or

not different from the control at all diammonium phosphate addition levels. Nicotine per CPM decreased from .074 (control) to a minimum of .069 representing a minus seven percent change. Nicotine per CPM per puff decreased from .0086 to .0077 with decreases ranging from minues 6 to minus 11 percent."

Q. But for the filters --

A. The statement in this first report is incorrect. These are the correct statements.

Q. Look at the paragraph above the one you were just looking at, sir, for the filtered cigarettes.

A. The results?

Q. No, just in the paragraph on page eight above that.

A. For filtered cigarettes?

Q. For filtered cigarettes, nicotine per puff is slightly higher.

A. Yes.

Q. Okay?

A. Yes.

Q. And then --

A. That's true.

Q. -- it says --

I'm sorry, turning back to page seven.

A. No, page seven says they've changed, but they

don't tell you which way they've changed. And -- and they're saying that there are statistically different differences between the control and the elevated levels of DAP, but in fact they go down, not up, which, although it may be statistically significant, is really not significant from an experimental point of view.

Now there's a Table 1 here which again shows it. May be the easiest place to look as a matter of fact. You notice under nicotine per CPM --

Q. Where are you looking now?

A. I'm on Table 1 on page 543, Bates number. The Y stands for yes, there's a statistical significance, and then associated with it is a direction and the percentage of change. And if you look under the heading nicotine per CPM, --

Q. Yes.

A. -- and you look down at the last three lines, which are the DAP at one percent, two percent and three percent above control, that says that, yes, there is a difference for the non-filter, and it's a reduction of 6.2 percent. And if you look at the filter, which is just to the left, it says yes, there's a difference, the increase is 1.9 percent.

Q. At one percent. The increase is 4.9 percent --

A. That's correct.
Q. -- at two and 3.5 percent at three?
A. Yes. And with a filter it's minus seven percent. And apparently three percent level with the filter or non-filter is not measurable. So there are really no differences here. They're --
Q. Well there are statistically --
A. -- tiny, tiny differences.
Q. There are statistically significant differences, though.
A. Well --
Q. Is that what the Y stood for, you said?
A. That's correct.
Q. And the filter cigarettes with DAP, the increase of the nicotine-to-tar ratio did show a trend as the amount of the DAP increased; correct?
A. Talking about the 1.9, 4.3, 3.5?
Q. Right.
A. I wouldn't call that a trend. It's two percent, round numbers, two percent, five percent, three percent. It's slightly elevated in the first case, it's slightly more elevated, then it goes back down. But these -- these -- these kind of percentages are -- are in the experimental error. Even though you can calculate statistical significance, they are

not.

Q. But at -- at the end of the day, what we have is a statistically significant increase of nicotine-to-tar ratio in filtered cigarettes with DAP compared to the control.

A. Well not in the control. So that if anything -- if you want to interpret it that way, if anything is happening, it's -- it's a result of the filter, but that's nonsense. What -- what this is is normal experimental variation.

Look at the ones above to the other additives. You're seeing a 16 percent increase. These are large enough to be meaningful numbers and to be real and not experimental error.

Q. So you -- you believe there's no significance to these, this is experimental error?

A. With respect to DAP? Yes.

Q. But with respect to the others, it would be valid?

A. Well I'd have to look at them carefully, but certainly some of the others are statistically significant and experimentally significantly different.

Q. With regard to Exhibit 1255, do you still believe that the reference that nicotine per CPM

increased for all additives is an error in the findings?

A. Yes, I do.

Q. Is there anything else in Exhibit 1255 that you believe is in error?

A. I have not seen anything. I didn't -- I didn't see that until you pointed it out.

Q. Anything else that comes to your attention as you look at it here?

A. No.

Q. Is there anything else about these particular exhibits that you intend to rely upon for your opinions at trial?

A. With respect to smoke pH and these kind of --

Q. With respect to any opinions you may render.

A. Well I would also indicate that these documents show no increase in transfer rate with the DAP either, which basically says in a selective fashion.

Q. What do you mean by "transfer rate?"

A. What I mean is a selective increase in the transfer of nicotine over CPM; in other words, the ratio. This is consistent with the opinion that I gave, I guess to the Wall Street Journal, which is my opinion as a scientist that the DAP would have no effect on pH or the transfer of nicotine in that

selective manner, so I would -- I would testify to that if asked.

I would also indicate, if asked, that I believe that with this additive and the normal variations in cigarettes, that there's absolutely no effect on nicotine uptake in the respiratory tract as a function of any of the variables that have been measured, some sort of a selective, manipulative kind of way. And I would generally respond to any question that I was asked in my deposition that I felt that I had the expertise to respond to.

Q. Is --

When you said a few moments ago that these studies do not show an increase in transfer rate with DAP and -- and you said you mean a selective increase in transfer of nicotine over CPM, is there other meanings to the word "transfer rate" other than transfer rate in comparison to CPM?

A. Well if you -- if you use the definition that any increase in transfer of nicotine is an increase from what's in the tobacco, you would conclude if you slow down the burn rate then you would get more puffs, you may increase the transfer. There is data here -- and I don't remember exactly what it says, but it certainly doesn't suggest there's any great

change in the transfer.
Q. In Exhibit 1255 in the findings they say, "As the percent additive levels were increased, corresponding increases were seen in nicotine transfer from leaf to smoke for either filtered or unfiltered cigarettes on per cigarette basis for...DAP...."
A. That -- that would be true. And also there was a corresponding increase in tar. But as I say, that -- that's really not different than saying I'll put a little more tobacco in the cigarette and you get more nicotine in the smoke.
Q. Except when you're doing it with diammonium phosphate and not more tobacco; correct?
A. Well you could do it with a less-porous paper on the cigarette. Anything to slow the burn rate.
Q. Anything else that you expect to testify about with regard to an opinion on the nicotine manipulation and ammonia technology?
A. No.
If asked about these other additives, I would -- I would be prepared to testify as to what our findings were with respect to them.
Q. Do any of these other additives mentioned in these studies get used in any Lorillard cigarette?

A. No, they do not.
Q. Have they been in the past?
A. Not to my knowledge.
I was just going to point you one quick second to 1256, the last page.
Q. Yes.
A. There is a percent transfer of nicotine from leaf down here at the -- the bottom row.
Q. Yes.
A. The transfer for the different levels of DAP 13.2, 12.7, 13.2, I think it's 13.4.
Q. You're looking on the left-hand column under "UNFILTERED CIGARETTES, PER CIGARETTE?"
A. "UNFILTERED CIGARETTES, PER CIGARETTE." So --
Q. Those are very hard to read.
A. They are.
MR. FINZEN: Counsel, do you know, is there a cleaner copy of this that doesn't have these numbers quite so smudged?
THE WITNESS: These were faxed. I think that's the problem.
MR. NORTHRIP: Not to my knowledge.
A. But if you --
If you look at all the additives, you see the transfer effects are -- are small. You're talking

about -- just reading down the column, 11.7, 13, 12.9 or 13.5, 12 -- and 12.4, so they're all in the range of 12 to 13 percent, so there's no major impact on the transfer.

Q. Well when you say there's no major impact, as the percentage goes up you're saying.

A. Yes.

Q. As compared to the control, however, they're all increased; correct? At every level.

A. Not -- not --

Q. For DAP they are.

A. No. But the others they are, but --

Q. Control, if I'm reading this right, is 12.1.

A. 12.1, right.

Q. And for DAP it goes from 13.2 to 15.4?

A. I think that's 15.4, at this very high level. But no, that's not the control for -- for DAP. The control for DAP is first 13.2 down there. That control at the top is for all the other additives.

Q. Oh, this is the one that -- this is the one that had zero percent for the controls.

A. That's right. That's right.

Q. And .4 for the DAP.

A. Right.

Q. Then you also said that you would render

opinions with regard to lawyer involvement in research.

A. Yes.

Q. What opinions do you intend to give in that regard?

A. Basically that I believe the lawyers were performing the functions that they should have performed with respect to their clients in terms of maintaining state-of-the-art awareness with respect to the evolve -- evolving science so that they could advise their clients appropriately with respect to liability, potential liability in the future. That to my knowledge lawyers were not controlling the science but certainly were maintaining themselves in terms -- maintaining themselves to be current with respect to information that scientists were generating, not only work sponsored by the industry but other work throughout the country. That's basically my opinion.

Q. And what do you base that opinion upon?

A. My personal knowledge.

Q. Any scientific basis for that opinion?

A. I don't know how you'd have a scientific basis for that opinion.

Q. And you also said that you may render an opinion

with regard to the so-called safer cigarette.
A. Yeah. Well that -- that basically is the Tobacco Working Group conclusions.
Q. Which you spoke to earlier this afternoon.
A. Yes. I -- I would indicate that --
I would speak to the conclusions of the program, which is they fail -- basically they fail to identify cigarette or cigarette modification that would lead to what would be referred to as a safer cigarette.
Q. Have -- (clearing throat) excuse me.
Have we now discussed all of the areas in which you expect to give expert testimony in this case?
A. I believe I have. I'm not sure we have specifically covered our testing program with respect to additives or ingredients.
Q. What opinions do you expect to render with regard to --
A. I would --
Q. -- that?
A. -- describe the testing program that Lorillard has employed with respect to flavorings and other ingredients that we add to our tobacco products, the nature of the program, the extensive nature of the testing, in general the type of findings and guidelines that exist in terms of decision-making

with respect to findings.

Q. Other than being able to describe factually the program and the findings that have been made, do you expect to render opinions with regard to the program itself and the findings that were reached?

A. With respect to Lorillard products, yes.

Q. And what would those opinions be?

A. That the ingredients that we are using do not impact the results in any of the bioassay systems that we employ.

Q. Any other opinions with respect to the testing program for additives?

A. No, other than I think it's a state-of-the-art program.

Q. And are there particular documents or studies that you rely upon to support that opinion?

A. My general knowledge of the field, the expertise of our staff, the consulting laboratories and laboratories that carry out the work, that would be the primary basis of that.

Q. Is there any particular documentation that you would rely upon for that that is either generated by Lorillard or by a consulting lab?

A. A document where that -- elements of that opinion are stated?

Q. Either that, or just documents to support that opinion.

A. No. We have --

I don't believe we've asked for the scientists who are working in the field to give us a documented opinion as to -- in writing that that is state of the art, for example. But --

Q. Is there anything --

A. -- I feel confident that that is their position, and that has certainly been relayed to me by our own internal organization.

Q. Is there any, in -- in existence, documents that you intend to rely upon to verify the -- the state-of-the-art nature of the work that's being done?

A. Just general -- general literature, which I can't identify for you specifically at this time.

Q. Any other areas of opinions that you expect to render at trial?

A. As I said, I think that covers everything that I'm aware of at the moment, but if I were asked questions beyond some of these that I felt I was -- had expertise to respond to, I would do so.

Q. Let me just verify a couple of other points here.

Have you taken course work at university level in endocrinology?

A. No.

Q. In biology?

A. At the graduate-school level?

Q. Graduate or university level.

A. I took some biology courses in undergraduate school.

Q. How many courses did you have?

A. I don't know. Typical general biology, I think genetics, are the ones that I recall.

Q. What about toxicology?

A. No. I -- I think that's all, the two I mentioned.

MR. FINZEN: All right, I think that concludes the expert depo.

MR. NORTHRIP: I guess we'll ask our friend from Philip Morris to exit and we --

Would you mind asking John to come in, please.

MR. DOCHERTY: Sure.

MR. NORTHRIP: If he's available.

THE REPORTER: Off the record, please.

(Deposition concluded at 5:00 o'clock p.m.)

C E R T I F I C A T E

I, Richard G. Stirewalt, hereby certify that I am qualified as a verbatim shorthand reporter; that I took in stenographic shorthand the testimony of ALEXANDER W. SPEARS III at the time and place aforesaid; and that the foregoing transcript consisting of pages 1 through 92 is a true and correct, full and complete transcription of said shorthand notes, to the best of my ability.

Dated at Charlotte, North Carolina, this 25th day of September, 1997.

RICHARD G. STIREWALT
Registered Professional Reporter
Notary Public

C E R T I F I C A T E

I, ALEXANDER W. SPEARS III, the deponent, hereby certify that I have read the foregoing transcript consisting of pages 1 through 92, and that said transcript is a true and correct, full and complete transcription of my deposition except:

ALEXANDER W. SPEARS III
Deponent

Sworn and subscribed to before me this day of , 1997.

Notary Public

My commission expires .